CLAIMS

1.   A method of monitoring electrical muscular activity non-invasively, the muscular
      activity being stationary or non-stationary, characterised in that the method
      incorporates the steps of:
      a)   providing a signal separation technique (50) suitable for separating stationary
            signals,
      b)   placing a plurality of low-noise signal electrodes (7, 8, 10, 11, 12) externally
            upon a patient's skin (40) for detection of muscular activity, the signal
            electrodes being localised sufficiently such that:
            i)   their muscular signal contributions simulate a single muscular source to
                  the signal separation technique (50) despite any non-stationarity of the
                  muscular source, and
            ii)   the number of sources detected by the signal separation technique (50)
                  is not more than the number of signal electrodes; and
      c)   applying the signal separation technique (50) to signals received from the
            signal electrodes (7, 8, 10, 11, 12) to separate the muscular source.

2.   A method according to Claim 1 characterised in that the muscular activity is uterine
      activity.

3.   A method according to Claim 1 characterised in that the signal separation technique is
      based on an instantaneous algorithm as herein defined.

4.   A method according to Claim 3 characterised in that the instantaneous algorithm is
      independent component analysis (ICA).

5.   A method according to Claim 4 characterised in that the step of applying the signal
      separation technique applies ICA to processing data derived from signals from the
      signal electrodes, the data being arranged in successive overlapping blocks such that
      in pairs of adjacent blocks each subsequent block incorporates a proportion of the
      data in the respective preceding block, and a correlation scheme is applied to re-order
      independent sources derived in ICA processing of different blocks to correct for signal
      swapping.

6.   A method according to Claim 1 characterised in that the step of placing the signal

electrodes comprises placing four or five signal electrodes (7, 8, 10, 11, 12) at and above navel height with respect to an upright patient at positions close to the expected site of pacemaker activity.

7. A method according to Claim 1 characterised in that the signal electrodes are a first set of signal electrodes (7,8,10,11,12) and the step of placing the signal electrodes includes placing a second set of signal electrodes (1, 2, 3, 4, 5, 6, 9) upon the patient's skin (40) in positions not localised sufficiently for their muscular signal contributions to simulate a single source to the signal separation technique (50), and wherein the signal separation technique (50) employs signals derived via the first set of signal electrodes (7,8,10,11,12) for monitoring non-stationary muscular activity and signals derived via the first and second sets of signal electrodes (1 to 12) for monitoring stationary muscular activity.

8. A method according to Claim 7 for monitoring uterine activity characterised in that the signal separation technique (50) simultaneously acquires maternal and fetal cardiac activity.

9. A method according to Claim 8 characterised in that the signal separation technique (50) additionally acquires uterine activity, maternal muscle activity, fetal ECG and maternal ECG.

10. An apparatus for monitoring electrical muscular activity non-invasively, the muscular activity being stationary or non-stationary characterised in that the apparatus incorporates:

   a) computer apparatus (36) for implementing a signal separation technique (50) suitable for separating stationary signals,

   b) a plurality of low-noise signal electrodes (7, 8, 10, 11, 12) for placing externally upon a patient's skin (40) for detection of muscular activity, the signal electrodes being suitable for localisation sufficiently such that:

      i)   their muscular signal contributions will simulate a single muscular source to the signal separation technique (50) despite any non-stationarity of the muscular source, and

      ii) the number of sources detected by the signal separation technique (50) will not be more than the number of signal electrodes; and

   c) processing means (34, 37 to 39) for processing signals received from the

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signal electrodes into digital signals suitable for application of the signal separation technique (50) by the computer apparatus (36) to separate the muscular source.

11.   Apparatus according to Claim 10 characterised in that the muscular activity is uterine activity.

12.   Apparatus according to Claim 10 characterised in that the signal separation technique is based on an instantaneous algorithm as herein defined.

13.   Apparatus according to Claim 12 characterised in that the instantaneous algorithm is independent component analysis (ICA).

14.   Apparatus according to Claim 13 characterised in that the computer apparatus (36) is programmed to arrange the digital signals in successive overlapping data blocks such that in pairs of adjacent blocks each subsequent block incorporates a proportion of the data in the respective preceding block, and to apply a correlation scheme to re-order independent sources derived in ICA processing of different blocks to correct for signal swapping.

15.   Apparatus according to Claim 10 characterised in that the signal electrodes (7, 8, 10, 11, 12) comprise four or five signal electrodes for placing at and above navel height with respect to an upright patient at positions close to the expected site of pacemaker activity.

16.   Apparatus according to Claim 10 characterised in that the signal electrodes are a first set of signal electrodes (7,8,10,11,12) and the apparatus includes a second set of signal electrodes (1, 2, 3, 4, 5, 6, 9) for placing upon the patient's skin (40) in positions not localised sufficiently for their muscular signal contributions to simulate a single source to the signal separation technique (50), and wherein the signal separation technique (50) is arranged to employ signals derived via the first set of signal electrodes (7,8,10,11,12) for monitoring non-stationary muscular activity and signals derived via the first and second sets of signal electrodes (1 to 12) for monitoring stationary muscular activity.

17.   Apparatus according to Claim 16 for monitoring uterine activity characterised in that

the signal separation technique (50) is arranged to acquire maternal and fetal cardiac activity simultaneously.

18.   Apparatus according to Claim 16 characterised in that the signal separation technique (50) is arranged to acquire uterine activity, maternal muscle activity, fetal ECG and maternal ECG.